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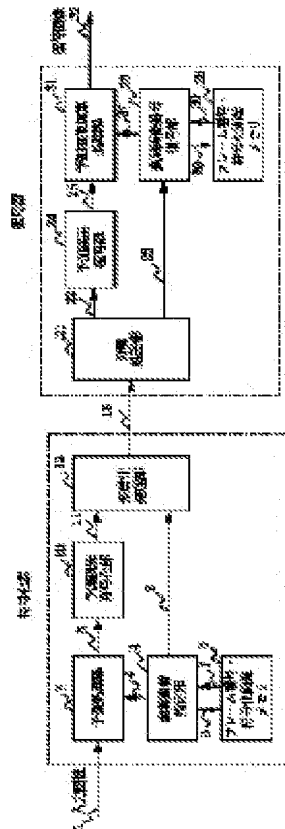
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### Abstract:

PROBLEM TO BE SOLVED: To reduce coding information by improving an inter-frame prediction efficiency in the case of coding a moving image through the use of inter-frame prediction.

SOLUTION: A frame number coding image memory 5 stores a reference frame number in time series and a reference image corresponding to the reference frame number. A reference image designation section 3 gives a reference frame number 6 to a frame number coding image memory 5 to obtain a reference image 7 of the reference frame number 6 and generates a prediction image 4 and outputs the reference frame number data 9 obtained by coding the reference frame number 6. A prediction processing section 2 compares an input image 1 with the prediction image 4 to provide an output of a prediction error image 8. The prediction error image 8 is coded by a prediction error coding section 10 into coded data 11. A multiplex processing section 12 multiplexes the coded data 11 and the reference frame number data 9 and provides an output of the result to a decoder as multiplexed coded data 13.



(57) **Abstract**

**Means for Solution**An image comparison corresponding to a reference frame number and these reference frame number of a time series is memorized by a frame number and the coded image memory 5. The image comparison specification part 3 hands over the reference frame number 6 in a frame number and the coded image memory 5, obtains the image comparison 7 of this reference frame number, generates the estimated image 4, and outputs the reference frame number data 9 which coded this reference frame number. In the forecast processing part 2, the inputted image 1 is compared with the estimated image 4, the prediction error image 8 is outputted, it is coded in the prediction error coding part 10, and the prediction error image 8 serves as the coding data 11. In the multiplex processing section 12, the coding data 11 and the reference frame number data 9 multiplex, and it is outputted to a decoder as the multiplexing coding data 13.

**Claim 1** In a video encoding method which codes video using inter frame prediction, A video encoding method, wherein a frame number of the order of a time series is given to coded image data, and it predicts to a picture which it is going to code from now on using a picture coded **arbitrary** and a frame number of a coded picture used for prediction also codes.

**Claim 3** The video encoding method according to claim 2 which uses linear combination of two or more coded pictures for prediction.

**Claim 5**The video encoding method according to claim 1 which uses for prediction only a picture of a frame number near the frame number of a picture which it is going to code from now on.

**Claim 6** A video encoding method of five given in any 1 paragraph from Claim 1 by which an identifier of a field unit is added to a frame number.

**Claim 7** A video decoding method predicting by getting to know a frame number of an image used for prediction to an image which it is going to decode after this in a video decoding method corresponding to a video encoding method of six given in any 1 paragraph from Claim 1.

**Claim 8** A video decoding method of Claim 7 which uses for prediction two or more coded pictures to which a maximum was set.

**Claim 9** The video decoding method according to claim 8 which uses linear combination of two or more coded pictures for prediction.

**Claim 10** The video decoding method according to claim 7 which uses for prediction linear combination of a part image which divided the whole picture into portions of arbitrary sizes and shape.

**Claim 11** The video decoding method according to claim 7 which uses for prediction only a picture of a frame number near the frame number of a picture which it is going to code from now on.

**Claim 12** A video decoding method of 11 given in any 1 paragraph from Claim 7 by which an identifier of a field unit is added to a frame number.

**Claim 13** A frame number and a coded image memory to which a reference frame number of the order of a time series was given and which has memorized a coded image comparison, A reference frame number is handed over in said frame number and coded image memory, Obtain said corresponding image comparison and the best estimated image of predictive efficiency is generated from the inside, Or divide the whole picture into portions of arbitrary sizes and shape, determine image comparison data and a reference frame number for every portion of the, and an estimated image is generated, An image comparison setting means which codes said reference frame number and is outputted as reference frame number data, A prediction processing means to output a prediction error comparing an inputted image with said estimated image, Coding equipment which has a multiplexing processing means to code said prediction error, to multiplex a prediction error encoding means outputted as coding data, and said coding data and said reference frame number data, and to output as multiplexing coding data.

**Claim 14** A Separation Sub-Division means to divide into coding data and a reference frame number multiplexing coding data which is a decoder corresponding to Claim 13 and was outputted from said multiplexing processing means, A prediction error decoding means which decodes said coding data and is changed into a prediction error, a frame number and a coded image memory in said coding equipment -- the same -- with a frame number and a coded image memory which has memorized an image comparison in which a reference frame number was given. Input a reference frame number from said Separation Sub-Division means, and this reference frame number is handed over in said frame number and coded image memory, A decoder which has an image comparison number decoding means which receives a corresponding image comparison, and generates and outputs an estimated image like said image comparison setting means, and an estimated image summing processing means to add said estimated image to said prediction error, and to output a decoded image.

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## Detailed Description of the Invention

### 0001

**Field of the Invention** This invention relates to the video encoding method and decoding method which code video using inter frame prediction.

### 0002

**Description of the Prior Art** By the conventional method, the way the direction of prediction saw by a time series, and predicted a new frame from an old frame was taken in the interframe predictive coding which uses one image comparison. Therefore, opposite direction prediction cannot be performed in simple inter frame prediction.

**0003** The inside of the frame to which interframe predictive coding of the above was carried out in the case of frame interpolation prediction, Two frames which see and continue by processing order can be used as a reference frame, and only the frame which sees by a time series and is pinched among those reference frames can use both reference frames as an image comparison. The frame which predicts two reference frames as an image comparison was not able to be

used as an image comparison in the coding processing after it.

**0004**This is because the rule which is carried out based on one or two frames which carried out interframe coding to just before, and is used as an image comparison defines the frame which can be referred to.

**0005**The encoding order of the conventional method and the example of an image comparison are shown in drawing 3. The frame number of the frame of 1, 5, and 8 is a reference frame, and interframe predictive coding of the 5th and the 8th frame is carried out based on the 1st frame. The frame interpolation coding of the 2nd inserted into them, the 3rd, and the 4th frame is carried out from the 1st and the 5th frame, and, as for the 6th and the 7th frame, frame interpolation coding is carried out from the 5th and the 8th frame.

**0006**

**Problem(s) to be Solved by the Invention**It was impossible to have seen by a time series and to have predicted by using a new frame as an image comparison in the conventional prediction method. It was impossible to have seen by a time series and to have used two or more frames for prediction from the same direction. There was restriction that the reference frame coded immediately before was to two.

**0007**The purpose of this invention raises inter-frame predictive efficiency, reduces encoded information by that cause, and there is in providing the video encoding method and decoding method which raise the compression ratio of a picture, the coding equipment corresponding to these, and a decoder.

**0008**

**Means for Solving the Problem**A video encoding method of this invention gives a frame number of the order of a time series to coded image data, it predicts to a picture which it is going to code from now on using a picture coded **arbitrary** , and a frame number of a coded picture used for prediction also codes.

**0009**A video decoding method of this invention predicts by getting to know a frame number of an image used for prediction to an image which it is going to decode from now on.

**0010**By giving a frame number of the order of a time series to a header of coded image data, and specifying an image comparison from the frame number at the time of decoding, distinction called inter frame prediction and frame interpolation prediction is lost, and a frame which can be referred to in prediction, and its number are generalized.

**0011**When coding a picture which is a coding subject using motion compensation inter frame prediction, two or more pictures of already coded arbitrary frame numbers can be used for prediction by specifying two or more frame numbers of an image comparison used for prediction.

**0012**Encoding order and an example of an image comparison are shown in drawing 2, and relation between a processing picture corresponding to this and a reference frame number is shown in Table 1.

**0013**

**Table 1**

For drawings please refer to the original document.

**0014**Linear combination prediction by two frames or three frames can be made intermingled by using a reference frame number regardless of a direction which performs inter frame prediction and inter frame prediction of an opposite direction, as shown in Table 1. Although here showed to an example used for prediction with reference to a maximum of three frames, four or more frames may be sufficient as a reference frame number.

**0015**In the decoding side, the frame number in the header of the image decoded beforehand and the decoded image which decoded corresponding image data are memorized, and an estimated image is generated like the coding side.

**0016**According to the embodiment of this invention, two or more frames referred to as an estimated image are prepared, they are changed, and it uses for prediction, or predicts by the linear combination of two or more pictures. Here, it not only can process prediction mode called such changes and linear combination to the whole picture of one frame, but it can process it to the part image which divided the whole picture into the portions of arbitrary sizes and shape.

**0017**For example, in drawing 2, although the 5th, the 7th, and the 8th frame can be used for the 6th-frame prediction, the example in the usable prediction mode to the 6th frame is shown in Table 2 as an example.

## 0018

### Table 2

For drawings please refer to the original document.

**0019**In other embodiments of this invention, the frame number which memorizes the picture required for prediction is restricted to  $\pm$ one  $N+M$  by restricting the frame referred to as an estimated image to the range of a frame to  $-N$ ,  $+M$  frame to be coded from now on. When this restriction does not exist, it is necessary to store all the pictures coded in the past.

**0020**In the embodiment of further others of this invention, video with an interlace signal like the present television signal. When the picture of one frame consists of the picture of the 2 fields by jump operation, not only a frame but the identifier of the field is used, and prediction of a field unit is enabled.

**0021**The frame number and coded image memory the coding equipment of this invention has remembered the coded image comparison in which the reference frame number of the order of a time series was given to be, A reference frame number is handed over in said frame number and coded image memory, Obtain said corresponding image comparison and the best estimated image of predictive efficiency is generated from the inside, Or divide into the portions of the arbitrary sizes of the whole picture, and shape, determine image comparison data and a reference frame number for every portion of the, and an estimated image is generated, The image comparison setting means which codes said reference frame number and is outputted as reference frame number data, A prediction processing means to output a prediction error comparing an inputted image with said estimated image, Said prediction error is coded, and the prediction error encoding means outputted as coding data, and said coding data and said reference frame number data are multiplexed, and it has a multiplexing processing means to output as multiplexing coding data.

**0022**A Separation Sub-Division means to divide into coding data and a reference frame number the multiplexing coding data in which the decoder of this invention was outputted from said multiplexing processing means, The prediction error decoding means which decodes said coding data and is changed into a prediction error, the frame number and coded image memory in said coding equipment -- the same -- with the frame number and coded image memory which has memorized the image comparison in which the reference frame number was given. Input a reference frame number from said Separation Sub-Division means, and this reference frame number is handed over in said frame number and coded image memory, A corresponding image comparison is received and it has an image comparison number decoding means which generates and outputs an estimated image like said image comparison setting means, and an estimated image summing processing means to add said estimated image to said prediction error, and to output a decoded image.

### 0023

**Embodiment of the Invention**Next, an embodiment of the invention is described with reference to Drawings.

**0024**Drawing 1 is a block diagram of the coding equipment of one embodiment of this invention, and a decoder.

**0025**Coding equipment comprises the forecast processing part 2, the image comparison specification part 3, a frame number and a coded image memory 5, the prediction error coding part 10, and the multiplex processing section 12.

**0026**The decoder comprises the separation sections 21, the prediction error decoding part 24, the estimated image addition processing section 31, the image comparison number decoding part 26, and a frame number and a coded image memory 28.

**0027.** The reference frame number of the time series was given to the frame number and the coded image memory 5. The coded image comparison is memorized, the reference frame number of a time series is given to a frame number and the coded image memory 28, and the same image comparison as the image comparison memorized by the coded image memory 5 is memorized.

**0028**The inputted image 1 is inputted into the forecast processing part 2, it is compared with the estimated image 4, and the prediction error image 8 is outputted. The image comparison specification part 3 hands over the reference frame number 6 in a frame number and the coded image memory 5, and obtains the image comparison data 7. As a result, in the image comparison specification part 3, the estimated image 4 with the most sufficient predictive

efficiency is generated out of the image comparison data 7 which serves as a candidate of prediction. Or in the image comparison specification part 3, the whole picture is divided into the portions of arbitrary sizes and shape, and the image comparison data used for prediction for every portion of the and a reference frame number are determined. The linear combination of two or more image comparison data can be used for this prediction. The smallest thing of a prediction error is chosen among the candidates of an estimated image. From the image comparison specification part 3, the reference frame number data 9 which coded the reference frame number selected besides the estimated image 4 is outputted. It is coded in the prediction error coding part 10, and the prediction error image 8 is outputted as the coding data 11. The coding data 11 and the reference frame number data 9 are multiplexed in the multiplex processing section 12, and are outputted from coding equipment as the multiplexing coding data 13.

**0029**In a decoder, the inputted multiplexing coding data 13 is divided into the coding data 22 and the reference frame number data 23 in the separation sections 21. In the prediction error decoding part 24, the coding data 22 is decoded and is changed into the prediction error image 25. The reference frame number data 23 is inputted into the image comparison number decoding part 26, specifies the reference frame number 29 to a frame number and the coded image memory 28 for every Type in a picture, and receives the image comparison data 30. In the image comparison number decoding part 26, the estimated image 27 is generated like the image comparison specification part 3, and it is outputted to the estimated image addition processing section 31. In the estimated image addition processing section 31, the estimated image 27 is added to the prediction error image 25, and the decoded image 32 is outputted.

### **0030**

**Effect of the Invention**As explained above, this invention by embedding the frame number referred to at the time of inter frame prediction at coding data, The flexibility of an image comparison improves, and since opposite direction prediction and prediction by the picture of three or more frames can also be efficiently predicted according to the feature of image rows, such as becoming possible, it is effective in the compression ratio in coding improving.

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### **Brief Description of the Drawings**

**Drawing 1**It is a block diagram of the coding equipment of one embodiment of this invention, and a decoder.

**Drawing 2**It is a figure showing the encoding order by Claim 1 of this invention, and the example of an image comparison.

**Drawing 3**It is a figure showing the encoding order of the conventional method, and the example of an image comparison.

### **Description of Notations**

- 1 Inputted image
- 2 Forecast processing part
- 3 Image comparison specification part
- 4 Estimated image
- 5 A frame number and a coded image memory
- 6 Reference frame number
- 7 Image comparison data
- 8 Prediction error image
- 9 Reference frame number data
- 10 Prediction error coding part
- 11 Coding data
- 12 Multiplex processing section
- 13 Multiplexing coding data
- 21 Separation sections
- 22 Coding data
- 23 Reference frame number data
- 24 Prediction error decoding part
- 25 Prediction error image
- 26 Image comparison number decoding part
- 27 Estimated image
- 28 A frame number and a coded image memory
- 29 Reference frame number
- 30 Image comparison data
- 31 Estimated image addition processing section
- 32 Decoded image

### **Drawing 2**

For drawings please refer to the original document.

### **Drawing 3**

For drawings please refer to the original document.

### **Drawing 1**

For drawings please refer to the original document.

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For drawings please refer to the original document.

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